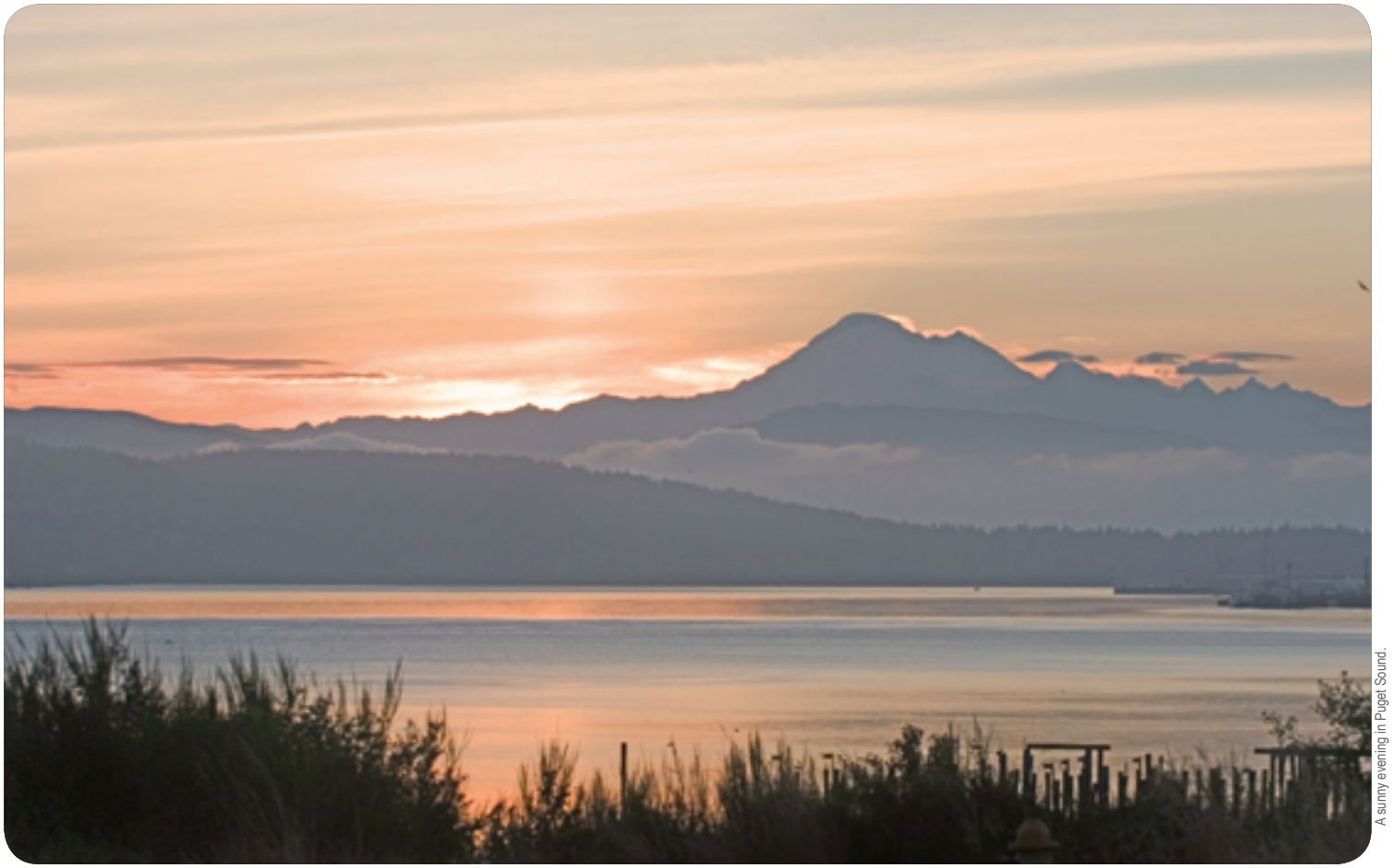

A sunny evening in Puget Sound.

EXECUTIVE SUMMARY

Climate Change and its Effects on Puget Sound

Profound changes have occurred in the Puget Sound environment over the past century and the next several decades will see even more change, according to this study prepared by the University of Washington's Climate Impacts Group. Based on extensive review of climate records and the current scientific literature, the report finds compelling evidence of change in the region.

> *"Profound changes have occurred in the Puget Sound environment over the past century and the next several decades will see even more change."*

Glaciers in the Cascade and Olympic Mountains have been retreating for 50-150 years. Pacific Northwest temperatures are rising faster than the global average. Puget Sound waters are warming, and river and stream flows are changing.

Human activities, primarily the burning of coal, oil and natural gas, have committed the planet to a different climate in the 21st century.

This report describes changes underway in Puget Sound, the potential future consequences of global warming, and why we need to prepare for impending change.

Projected changes include:

- **Continued increases in temperature.** Even the most conservative scenarios show the climate of the Pacific Northwest warming significantly more than was experienced during the 20th century.
- **Continued increases in water temperature.** Surface water temperature in Puget Sound and in the rivers and streams that feed into it would also increase.

- **Continued alteration of river and stream flows.** With decreased snowpack and earlier snowmelt, western Washington's low summer stream flows are likely to be further reduced, while winter stream flows rise, altering the timing of freshwater inputs to marine waters.

- **Increased flooding.** With more of the region's winter precipitation falling as rain rather than snow, flooding in Puget Sound watersheds would likely increase. If winter precipitation increases, as some models suggest, the risk of flooding would be compounded.

- **Accelerated rates of sea level rise,** especially in south Puget Sound where the effects of sea level rise are compounded by sinking land. The rate of rise in the Pacific Northwest is projected to be faster than the global average and is likely to increase both the pace and extent of the erosion and nearshore habitat loss already affecting Puget Sound shorelines.

- **Loss of nearshore habitat.** Sea level rise, temperature change and changes in nutrient availability may lead to further declines in critical marsh and coastal wetland habitats.

- **Salt marshes at risk.** Projected changes in water temperature, water salinity and soil salinity could change the mix of plant species in salt marshes and the viability of invertebrates that play a key role in the health of salt marsh systems.

- **Further pressures on salmon.** Lower summer flows and warming waters may negatively affect salmon that depend on rivers during the summer months.

- **Warmer water temperature,** potentially putting many species at risk. Plankton, the foundation of Puget Sound's food web, are sensitive to temperature change. Temperature-driven shifts in plankton could ripple through the food web, changing the composition of invertebrates, fish and mammal communities.

- **Increased likelihood of algal blooms and low oxygen concentrations in bottom waters.** Increased algal productivity in surface waters would lead to a further depletion of oxygen at depth.

> *"Because of lags in the climate system, warming and sea level rise will continue for centuries even if concentrations of greenhouse gases in the atmosphere were stabilized today."*

The scientific projections in this report are based on the best available knowledge today. The ultimate impact of climate change on any individual species or ecosystem cannot be predicted with precision. This is because impacts will depend not only on how climate changes reverberate across the food web but also on future changes in related factors, including human activities, many of which are now unknown or poorly understood.

Significant, profound change

In short, the evolutionary environment in which Puget Sound's many species of plants and animals have developed over the past 10,000 years is undergoing significant changes, changes that will likely have profound effects on the living resources of Puget Sound.

Unfortunately, climate change can't be fixed within a short period of time even if we had the funding and the resolve to do so. Because of lags in the climate system, warming and sea level rise will continue for *centuries* even if concentrations of greenhouse gases in the atmosphere were stabilized *today*.

The ultimate impact of climate change in Puget Sound depends not only on future levels of greenhouse gases, but also on choices we make in the region about dealing with climate change.

Dawn breaks over the industrial area of Fidalgo Bay near Anacortes.

We need to increase our capacity to cope with the large-scale climate impacts facing the Puget Sound region. By understanding and incorporating the projected effects of climate change into the region's planning, management and development, we may be able to increase the Sound's and our society's resilience to that change.

"Preparing for climate change is a high-stakes exercise in risk management."

A few key principles can guide our management and adaptation.

We must:

- Recognize that the past may no longer be a dependable guide to the future,
- Take actions to increase the adaptability of regional ecosystems to future change,
- Monitor regional climate and ecosystems for ongoing change,
- Expect surprises and design for flexibility to changing conditions.

Preparing for climate change is a high-stakes exercise in risk management. The likelihood of substantial changes and disruption to the physical and biological environment of Puget Sound requires active and prudent management to prepare for these risks.

The simple act of firing up a fossil-fuel burning vehicle contributes to climate change. Transportation will be one of many issues on the table as policymakers grapple with ways to reduce greenhouse gases and the resulting harm a warmer climate may cause to Puget Sound.